

CLAIMS

1. A hybrid driving unit, comprising:
 - an input shaft for inputting motive power from an internal combustion engine;
 - an output shaft disposed on an axis in line with said input shaft and interlocking with driving wheels;
 - a first electric motor disposed on said axis and having a stator and a rotor;
 - a power splitting planetary gear disposed on said axis and having a first rotary element coupled with said input shaft, a second rotary element coupled with said rotor of said first electric motor and a third rotary element coupled with said output shaft;
 - a second electric motor disposed on said axis and having a stator and a rotor; and
 - a transmission disposed on said axis and shifting and transmitting revolution of said rotor of said second electric motor to said output shaft: and
 - said hybrid driving unit being characterized in that:
 - said first electric motor, said power splitting planetary gear, said second electric motor and said transmission are stored in a casing member while being disposed in line on said axis;
 - said stators of said first and second electric motors are fixed to said casing member;
 - and
 - said first electric motor, said power splitting planetary gear, said second electric motor and said transmission are disposed along said axis such that said second electric motor is positioned on the side closer to said internal combustion engine than said first electric motor.
2. The hybrid driving unit as set forth in Claim 1, characterized in that said second electric motor is disposed in the foremost part among said first electric motor, said

power splitting planetary gear, said second electric motor and said transmission disposed on said axis of said casing member.

3. The hybrid driving unit as set forth in Claim 2, characterized in that said transmission is provided adjacent to said second electric motor.

4. The hybrid driving unit as set forth in Claim 2, characterized in that supporting members extending from said casing member support the both sides of said rotor of said second electric motor through an intermediary of bearing members; and said supporting member between said second electric motor and said transmission, among said supporting members, forms a hydraulic chamber of a hydraulic actuator of said transmission.

5. The hybrid driving unit as set forth in Claim 4, characterized in that at least a part of said hydraulic chamber is provided on the inner diametric side of said stator (coil end) of said second electric motor.

6. The hybrid driving unit as set forth in Claim 1, characterized in that said second electric motor, said transmission, said power splitting planetary gear and said first electric motor are disposed in order from the side closer to said internal combustion engine.

7. The hybrid driving unit as set forth in Claim 6, characterized in that said input shaft passes through the inner peripheral side of said second electric motor and said transmission and is coupled with said ring gear, and said output shaft passes through the inner peripheral side of said power splitting planetary gear and said first electric motor and

is coupled with an output element of said transmission through the outer peripheral side of said power splitting planetary gear.

8. The hybrid driving unit as set forth in Claim 7, characterized in that said power splitting planetary gear comprises a double pinion planetary gear train;

said input shaft passes between said transmission and said power splitting planetary gear and is coupled with a ring gear of said double pinion planetary gear train;

said output shaft is coupled with a carrier of said double pinion planetary gear train on the side of said transmission through the inner peripheral side of said power splitting planetary gear;

said rotor of said first electric motor is coupled with a sun gear of said double pinion planetary gear train; and

said output element of said transmission is coupled with said carrier of said double pinion planetary gear train on the side of said first electric motor through the outer peripheral side of said power splitting planetary gear.

9. The hybrid driving unit as set forth in Claim 7, characterized in that supporting members extending from said casing member support the both side of said rotor of said first electric motor through an intermediary of bearing members; and

said output shaft is supported by the inner peripheral surface of said rotor of said first electric motor through an intermediary of bearing members provided at the outer peripheral surface of said output shaft.

10. The hybrid driving unit as set forth in Claim 9, characterized in that said supporting members extending from said casing member support the both sides of said rotor of said second electric motor through the intermediary of said bearing members and

said input shaft is supported by the inner peripheral surface of said rotor of said second electric motor through an intermediary of a bearing member provided at the outer peripheral surface of said input shaft.

11. The hybrid driving unit as set forth in Claim 1, characterized in that said second electric motor, said transmission, said first electric motor and said power splitting planetary gear are disposed in order from the side closer to said internal combustion engine.

12. The hybrid driving unit as set forth in Claim 11, characterized in that said input shaft passes through the inner peripheral side of said second electric motor, said transmission, said first electric motor and said power splitting planetary gear and is coupled with said first rotary element, said output shaft passes through the outer peripheral side of said power splitting planetary gear, and the output element of said transmission passes through the inner peripheral side of said first electric motor and said power splitting planetary gear and is coupled with said output shaft.

13. The hybrid driving unit as set forth in Claim 12, characterized in that said power splitting planetary gear comprises a double pinion planetary gear train;

said input shaft is coupled with said ring gear of said double pinion planetary gear train through the back of said power splitting planetary gear;

said output shaft is coupled with said carrier of said double pinion planetary gear train on the side of said first electric motor;

said rotor of said first electric motor is coupled with said sun gear of said double pinion planetary gear train; and

said output element of said transmission is coupled with the rear side of said carrier of said double pinion planetary gear train through the inner peripheral side of said power splitting planetary gear.

14. The hybrid driving unit as set forth in Claim 11, characterized in that said supporting members extending from said casing member support the both sides of said rotor of said first electric motor through an intermediary of bearing members; and

said output element of said transmission is supported by the inner peripheral surface of said rotor of said first electric motor through an intermediary of bearing members provided on the outer peripheral surface thereof.

15. The hybrid driving unit as set forth in Claim 11, characterized in that said supporting members extending from said casing member support the both sides of said rotor of said second electric motor through the intermediary of the bearing members; and

said input shaft is supported by the inner peripheral surface of the rotor of said second electric motor and by the inner peripheral surface of the output element of said transmission through an intermediary of bearing members provided on the outer peripheral surface of said input shaft.

16. The hybrid driving unit as set forth in Claim 11, characterized in that the supporting member between said second electric motor and said transmission, among said supporting members, forms said hydraulic chamber of said hydraulic actuator of said transmission.

17. The hybrid driving unit as set forth in anyone of Claims 1 through 16, characterized in that said transmission has a planetary gear unit.

18. The hybrid driving unit as set forth in Claim 17, characterized in that said transmission has at least four shifting elements, said first shifting element is coupled with said rotor of said second electric motor, said second shifting element is coupled with said output shaft, and said transmission has braking elements which are capable of fixing said third and fourth shifting elements to said casing member, respectively.

19. The hybrid driving unit as set forth in Claim 17, characterized in that said planetary gear unit of said transmission comprises a Ravigneaux type planetary gear and said carrier of the Ravigneaux type planetary gear is coupled with said output shaft.

20. A vehicle comprising an internal combustion engine, hybrid driving means and rear wheels as driving wheels to which driving force is transmitted from said hybrid driving means is characterized in that said hybrid driving means is said hybrid driving unit described in anyone of Claims 1 through 19 in which said input shaft is coupled with an output shaft of said internal combustion engine, said propeller shaft is coupled with said output shaft, and said output shaft of said internal combustion engine, said input shaft, said output shaft and said propeller shaft are disposed approximately on one and same axial line.